ABSTRACT OF THE DISCLOSURE

A spectrometer, or a spectral instrument using multiple non-interfering optical beam paths and special optical elements. The special optical elements for use with the instrument are used for directing the optical beam and/or altering the form of the beam. The instrument has the potential, depending upon the totality of the optical components incorporated into the instrument, to be a monochromator, a spectroradiometer, a spectrophotometer and a spectral source. The spectral instrument may further be a part of the spectral system. The system may include the spectral instrument, a power module and means for remote control of the instrument. Such remote control may be by use of a personal computer or a control system dedicated to the control, measurement and analysis of the collected information. The multiple non-interfering beam paths are created using specially designed optical elements such as a diffraction grating, a splitter box, a zero back-lash drive system for movement of the grating element. The orientation of and a physical/spatial relationship between the field lenses, slits, return mirror, reflecting prism, turning lenses all define the multiple, preferably two paths. Particularly, there is a double pass through the grating to increase dispersion, reduce scatter while maintaining a perfect temperature independent spectral match for the second pass. Using the same grating twice reduces scatter by about a factor of 1000, increases the dispersion by a factor of two, and eliminates any temperature-related mechanical spectral drift which often is present with two separate monochromators. Because of the specially designed grating structure, the grating can cause the concurrent diffraction of a plurality of incident optical beams, each of which beams have different angles of incidence and different angles of reflection. The path of the incident and the reflected beam to and from the grating is "off-axis". That is, the beams going to and from the grating do not use the optical axis of the grating structure.